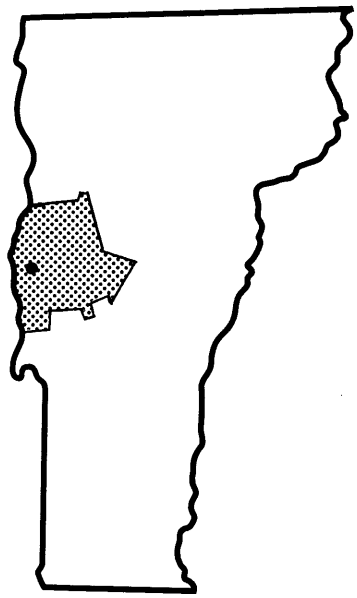
FLOOD INSURANCE STUDY

TOWN OF BRIDPORT, VERMONT

ADDISON COUNTY



FEBRUARY 1979

U.S. DEPARTMENT of HOUSING & URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

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FLOOD INSURANCE STUDY

TOWN OF BRIDPORT,
ADDISON COUNTY, VERMONT

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the Town of Bridport, Addison County, Vermont, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert the Town of Bridport to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain management.

1.2 Coordination

An initial coordination meeting was held on April 19, 1976, between local officials and representatives of the Federal Insurance Administration and the Study Contractor in order to determine the areas to be studied in detail and those to be studied using approximate methods. An announcement of intent to perform a flood elevation study appeared in the Addison County Independent on July 22, 1976. The Vermont Department of Water Resources, the New York State Department of Environmental Conservation, and the Addison County Regional Planning Commission were notified of the study, and a request was made for any pertinent information. The U. S. Department of the Interior, Fish and Wildlife Service, was contacted to obtain available topographic mapping of the detailed study area. The community was requested to submit data concerning flood hazards, flooding experience, plans to avoid potential flood hazards, and any other data deemed appropriate. Periodic contacts were made with local community officials to keep them informed of the progress of the study and to solicit pertinent information. The New York State Department of Transportation, Waterways Maintenance Group, was contacted, and their 60 years of lake level observations at Whitehall, New York, were obtained. The U. S Geological Survey (USGS) forwarded their records for annual peak lake levels at Whitehall, South Bay, and the Fort Ticonderoga Railroad Station starting in April 1969. Dufresne-Henry Engineering Corporation was also in attendance at a meeting on Lake Champlain Study Methods conducted by representatives of the Federal Insurance Administration held in Montpelier, Vermont.

A final coordination meeting was held on September 19, 1978 to resolve any problems or conflicts with the results of this study and to provide an opportunity for local community officials to become familiar with the planning material being provided. The meeting was attended by local officials and representatives of the Federal Insurance Administration and the Study Contractor. The study was accepted.

1.3 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Dufresne-Henry Engineering Corporation for the Federal Insurance Administration, under Contract No. H-4020. This work, which was completed in February 1978, covered all significant flooding sources affecting the Town of Bridport.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Bridport. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, areas of projected development and proposed construction until 1982.

Approximate methods of analysis were used to study those areas having low development potential and/or minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the Federal Insurance Administration and the community.

Flood hazard determinations for Lake Champlain were based on detailed study methods. West Branch Dead Creek, East Branch Dead Creek, Potash Brook, Lemon Fair River, Braisted Brook, and several unnamed tributaries were studied by approximate methods.

2.2 Community Description

The Town of Bridport is located in the western portion of Addison County in west-central Vermont. It is bounded on the west by Lake Champlain and Essex County, New York, on the north by the Town of Addison, Vermont, on the east by the Towns of Weybridge and Cornwall, Vermont, and on the south by the Town of Shoreham, Vermont. The 1975 population estimate of 900 represents an 11 percent increase over the 1970 census (Reference 1). The population of the town is fairly well distributed throughout, with a small concentration in the village area.

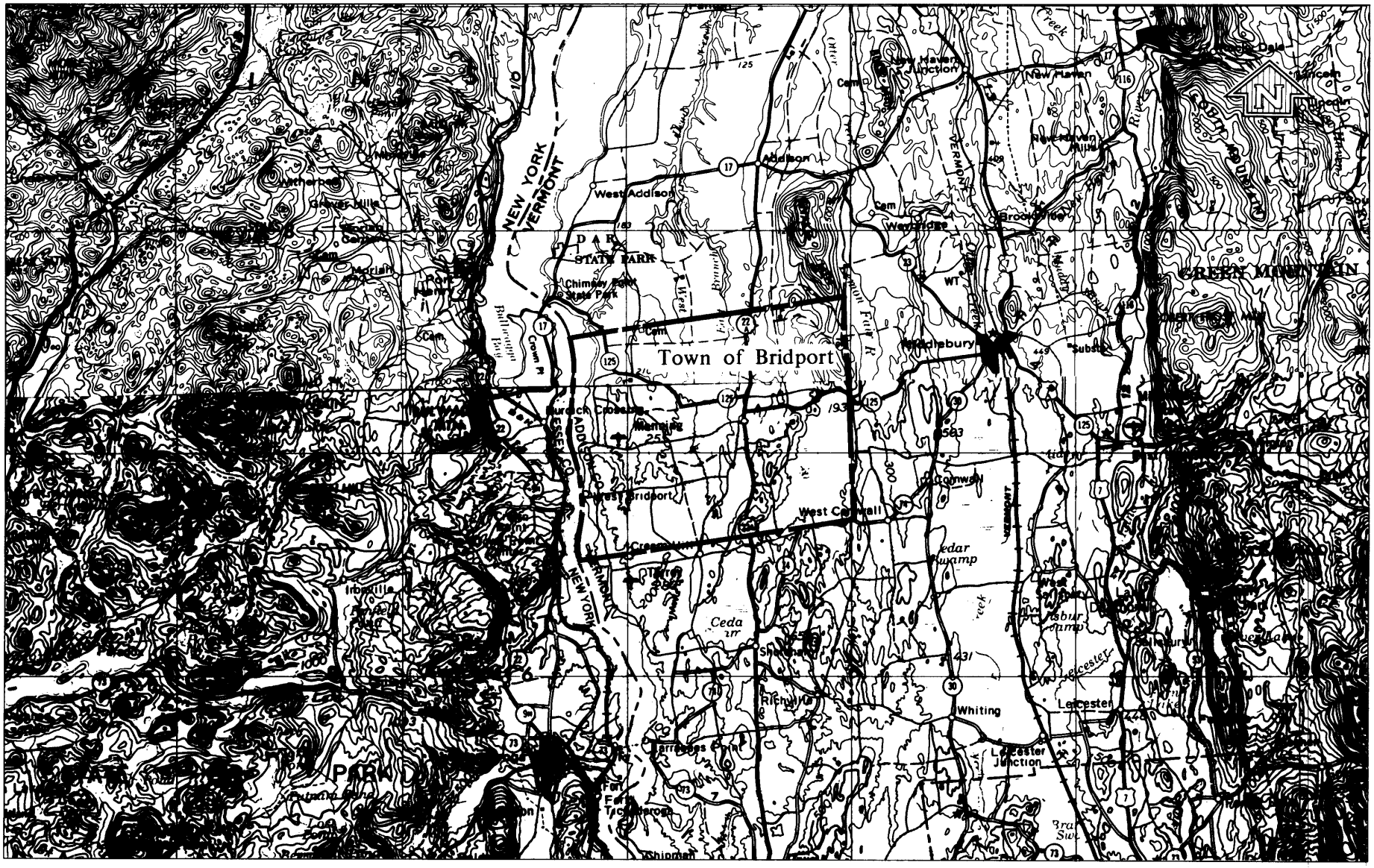

FIGURE 1

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF BRIDPORT, VT
(ADDISON CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The climate of this region is influenced by Lake Champlain and the adjacent barriers, the Green Mountains and the Adirondacks. Lake Champlain has a significant moderating effect on the climate, extending the growing season to as much as 150 days at lakeside. Because the weather patterns are affected by the Green Mountains and the Adirondacks, along with some influence from the Taconic Mountains to the south, this valley is protected from most northeasters and tropical storms. The prevailing surface winds are generally from the south with frequent shifts to the north during the winter. Winter snows are light, averaging 60 to 70 inches annually. The average annual precipitation is also light, being only 33 inches. The average annual temperature is 46.3 degrees Fahrenheit (F.), comprised of five months, May through September, when the monthly mean is greater than 55 degrees F., and then for a portion of the winter, December through February, when the monthly means are less than 25 degrees F. (Reference 2).

The topography within the town is fairly uniform with gently rolling hills. The high point in town is Hemingway Hill with an elevation of 618 feet. The region is underlain by sandstone and quartzite of Cambrian age or by shale, slate, and limestone of Ordovician age. The hills on the easterly side of town are formed by outcrops of limestone bedrock. The soils in the town are formed by outcrops of limestone bedrock. The soils in the town are primarily silt and clay deposits resulting from post-glacial Lake Vermont.

The drainage pattern in the town is dendritic. The principal waterways are the Lemon Fair River, Potash Brook, Dead Creek, Braisted Brook, and Lake Champlain. The Lemon Fair River and the other creeks and brooks have their headwaters in the low-lying hills of this and other immediately surrounding towns. They flow to the north and eventually drain into Lake Champlain. Lake Champlain is one of the largest bodies of fresh water in the United States, with a surface area of 490 square miles, and is over 100 miles long, measured from the northern end at Rouses Point where it enters the Richilieu River to the southern end near Lock 12C of the New York Barge Canal System.

Addison County has some of the best agricultural land in the State of Vermont. Farming is the most important enterprise in the Town of Bridport. A large portion of the cropland is being used to grow corn and hay in support of dairy farming, with some apple orchards growing close to Lake Champlain (Reference 3). Very little development has taken place on the flood plain as the soils are generally not suited for construction and are even difficult to till for agricultural purposes.

2.3 Principal Flood Problems

Flood damage in the Town of Bridport has been caused primarily by the high levels of Lake Champlain and the consequent erosion of the silt-clay materials along the shore. The high lake levels have caused the flooding of

some recreational properties near or on Lapham Island during the extreme high lake stages recorded in April and May 1971, 1972, and 1976. The 1976 flood had a recurrence interval of 25 years. The rise in lake level is often associated with sudden snowmelt in the mountains which results in an enormous volume of water released from the mountainous, large drainage area of Lake Champlain (8,277 square miles). The area which is sustaining the greatest amount of damage associated with flooding is the shore of Lake Champlain, where substantial amounts of erosion are taking place and a few seasonal dwellings of recent construction have been flooded. There are no reported instances of residential flooding along the other creeks, brooks, and rivers in the Town of Bridport. Photographs of flood elevations are shown in Figures 2 through 4.

2.4 Flood Protection Measures

There are no flood control structures existing or authorized in the Town of Bridport at the time of this study.

3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10-, 50-, 100-, and 500-years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the watersheds of the streams.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail in the community.

The analyses of the levels of Lake Champlain at the Bridport-Shoreham town boundary were based on an extension of the statistical analysis of the annual peak stages recorded at Rouses Point, New York, USGS gage No. 04295000, as evaluated by the U. S. Army Corps of Engineers (COE) using a log-Pearson Type III analysis (References 4 and 5). In the COE analysis, the flood levels from the period of continuous record, 1938-1976 (38 years of record), were used. Peak stages as recorded at the USGS crest-stage gage located at the Fort Ticonderoga Railroad Station for the years of 1969 through 1976 (7 years of record) were used in addition to the observations of local residents to transfer the statistical analysis for Rouses Point to the Fort Ticonderoga gaging site. This was then adjusted for the slope from that site to the Lake Champlain Toll Bridge at Chimney Point by using an average value of the stage at Rouses Point and Fort Ticonderoga (Reference 6). This was necessary to adjust for the quadrant on Lake Champlain and was approved in a Special Problem Report (Reference 6). The summary of elevations for Lake Champlain without wave or run-up heights is shown in Table 1.

FIGURE 2. Erosion Potential of Lake Champlain.

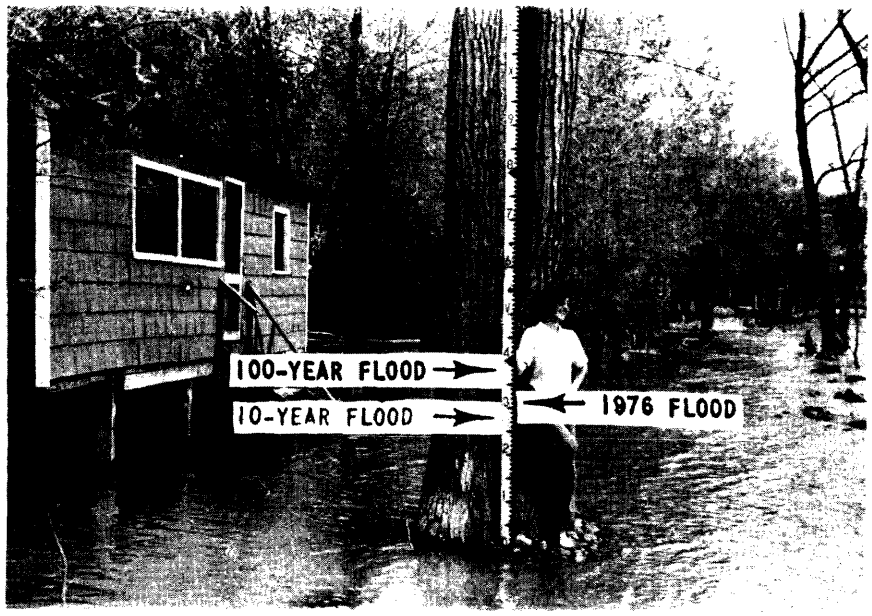

FIGURE 3. Flood Elevations at Lapham Island Access Road.

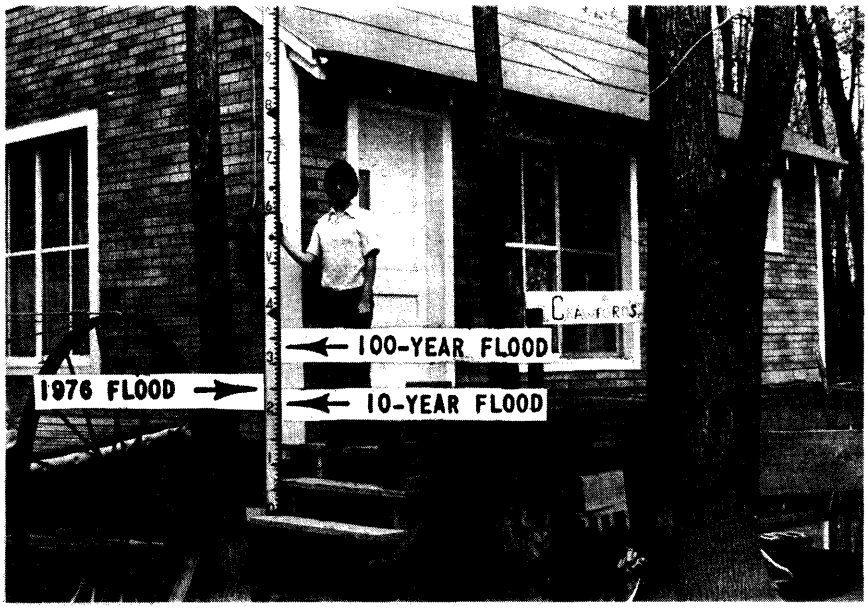

FIGURE 4. Flood Elevations at a Lapham Island Camp.

TABLE 1: SUMMARY OF ELEVATIONS

LOCATION	ELEVATIONS (NGVD) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LAKE CHAMPLAIN	101.43	102.27	102.53	102.99

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community are carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along the flooding source studied in detail.

The ultimate water levels on Lake Champlain can be higher by adding the dynamic effect of wind generated waves and run-up. For purposes of providing information necessary to permit the assessment of flood hazards and flood plain management, the Federal Insurance Administration is satisfied with the water levels determined by hydrologic methods, and not with wave run-up. Elevation reference marks are shown on the Flood Insurance Rate Map to assist the users in determining more accurately the boundaries of the 100- and 500-year floods and to provide a means for determining the first floor elevations of local structures.

For the approximate study areas, no detailed hydraulic studies were performed because of the lack of current or planned development along these streams in the immediate future. Approximate elevations of the 100-year flood on streams not studied by detailed methods were determined by a combination of limited field reconnaissance and a regional stage-frequency relationship developed for streams in Vermont (Reference 7).

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the

community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using topographic maps photoenlarged to a scale of 1:9600, with a contour interval of 20 feet (Reference 8). For the Lemon Fair River, Potash Brook, Dead Creek, Braisted Brook, and other unnamed streams studied by approximate methods, the flood boundaries were delineated using the above-referenced topographic maps.

Flood boundaries are indicated on the Flood Insurance Rate Map (Panels 0001-0020). On this map, the 100-year flood boundary corresponds to the boundary of the areas of special flood hazards (Zones A and A2); and the 500-year flood boundary corresponds to the boundary of areas of moderate flood hazards (Zone B). Small areas within the flood boundaries may lie above the flood elevations, and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source affecting the Town of Bridport.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than 0.5 foot for more than 20 percent of the reach.

One reach meeting the above criterion was required for Lake Champlain, the flooding source of the Town of Bridport.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their Flood Hazard Factors are used to set actuarial insurance premium rate tables based on Flood Hazard Factors from 005 to 200.

The Flood Hazard Factor for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if

the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the Flood Hazard Factor is 005; if the difference is 1.4 feet, the Flood Hazard Factor is 015; if the difference is 5.0 feet, the Flood Hazard Factor is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the Flood Hazard Factor is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire area of the Town of Bridport was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or Flood Hazard Factors determined.
Zone A2:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factor
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 2, "Flood Insurance Zone Data," summarizes the flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
LAKE CHAMPLAIN REACH 1	0005, 0015	−1.1	−0.3	0.5	010	A2	103

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF BRIDPORT, VT
(ADDISON CO.)

FLOOD INSURANCE ZONE DATA

LAKE CHAMPLAIN

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Bridport is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

In 1976, the Federal Insurance Administration completed a Type 15 Flood Insurance Study for the City of Plattsburgh, Clinton County, New York, in which flood elevations were established for Lake Champlain (Reference 9). The elevations established for the City of Plattsburgh were found to be inappropriate for the southern end of Lake Champlain through the analysis of short-term crest-stage gages (Reference 10) and the long period of daily observations by the New York State Department of Transportation, Waterways Maintenance Group (Reference 11). There are ongoing studies of Lake Champlain for flood control purposes by the International Joint Commission. Since the completion of several studies for the International Joint Commission, a decision will be made relating to structural measures that could be completed on the Richelieu River to regulate Lake Champlain water levels (Reference 12).

None of the above-mentioned studies have determined stage-frequency relationships in the Town of Bridport.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, 15 New Chardon Street, Boston, Massachusetts 02114.

8.0 REFERENCES AND BIBLIOGRAPHY

1. The Sunday Rutland Herald and the Sunday Times Argus, "By 1975, Vermont Had 471,000 Residents," May 22, 1977.

2. U. S. Department of Agriculture, Soil Conservation Service, Soil Survey, Addison County, Vermont, October 1971

3. Vermont Land Planning Office, Vermont Land Capability, September 1974.

4 U. S. Army Corps of Engineers, New York District, Exhibit J presented at a meeting on Lake Champlain Study Methods held in Montpelier, Vermont, November 10, 1976.

5. U. S. Water Resources Council, Bulletin No. 17, Guidelines for Determining Flood Flow Frequency, Washington, D. C., March 1976.

6. Dufresne-Henry Engineering Corporation, Special Problem Report, submitted to the Federal Insurance Administration, March 1977; with approval of proposed solution received April 1977.

7. Vermont Department of Water Resources, Agency of Environmental Conservation, Management and Engineering Division, Identification of Flood Hazard Areas in Vermont, August 1974.

8. U. S. Geological Survey, 15 Minute Series Topographic Map, Scale 1:62500, Contour Interval 20 feet: Port Henry, New York-Vermont, 1945.

9. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Plattsburgh, New York, 1976.

10 Bernard Dunn, Hydrologist, New York District, Water Resources Division. U. S. Geological Survey, Correspondence to Gordon Ayer, Chief Hydrologist. Dufresne-Henry Engineering Corporation, August 27, 1976.

11. New York State Department of Transportation, Region I, Waterways Maintenance, Lake Champlain Water Level Records at Gage No. 126, 1916-1976.

12. International Champlain Richelieu Board, Technical Report of Physical Aspects Committee, Technical Report of Net Benefits Committee, Technical Report of Environmental Impact Committee, in Regulation of Lake Champlain Upper Richelieu River, December 1977.

Chow, V. T., Handbook of Applied Hydrology. New York: McGraw-Hill Book Company, Inc., 1964.

King, H. W., and E. F. Brater, Handbook of Hydraulics, 5th Edition. New York: McGraw-Hill Book Company, Inc., 1963.

Linsley, R. K., M. A. Kohler, and J. L. Paulhaus, Hydrology for Engineers. 2nd Edition. New York: McGraw-Hill Book Company, Inc., 1975.

State of Vermont, Agency of Environmental Conservation, Department of Water Resources, Lake Champlain Water Levels, Observations at Rouses Point, New York, 1869 - Present, August 1977.

62nd Congress of the United States, 3rd Session, U. S. House Document 1387 - Narrows of Lake Champlain, U. S. Army Corps of Engineers, Washington, D. C., 1911.

U. S. Army Corps of Engineers, Coastal Engineering Research Center, Shore Protection Manual, 2nd Edition, 1975.

U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Lake Survey Center, Navigational Chart, Scale: 1:40000, Soundings in Feet, Lake Champlain, Barber Point, New York to Whitehall, New York, Chart No. 174, 1974.

U. S. Department of the Interior, Fish and Wildlife Service, Photogrammetic Map, Scale: 1:2500, Contour Interval 0.5 meters: Lake Champlain, Lapham Island, Addison County, Vermont, 1976.